

Preventing Outdoor Same Level Slips, Trips and Falls

Highlights:

- Trip hazards
- Sidewalks, curbs and parking lots
- Curb ramps and handicap ramps
- Ice, snow, water
- Selection of ice melting chemicals
- Outdoor lighting

This reference note addresses slip, trip and fall hazards, and describes interventions, including outdoor walkway design and maintenance, visible warnings, and snow/ice removal strategies. Walkway surfaces include sidewalks, curbs, parking areas, curb ramps and entrances.

Stairway design is not addressed in this reference note. See reference note LC 5158, *Controlling Falls on Stairways*, for guidelines on stairway fall prevention.

Slips, trips and falls in outdoor environments can be caused by rain, sleet, ice and snow, and particulate soil that cause surfaces to become slippery or produce poor traction. While we cannot control environmental conditions that increase slipperiness of outdoor walkway surfaces, we can certainly reduce the likelihood of falls through improved design of exterior sidewalks, curbs, parking areas, improved lighting and improved maintenance to increase awareness and eliminate hazards.

Trip Hazards

A trip occurs when the foot strikes a near-ground obstacle that abruptly arrests the movement of the foot when the body's center of gravity is in motion. This causes the center of gravity to rapidly move out of the area of the body's support base (the planted foot), resulting in a fall. A trip most often results in the person falling forward, while a slip most often results in the person falling backward.

Most state, local and federal codes and standards describe changes in elevation of ¼ inch or higher in the course of travel as a trip hazard. These elevation obstacles should be eliminated through facility design or maintenance, if at all possible. However, if elimination is not possible, other options include:

- For changes of level ¼ inch to ½ inch (6 mm to 13 mm), bevel the edge with a slope no greater than 1:2.

Slope is the angle of incline usually given as a ratio of the rise (or vertical height) to the run (or horizontal length). The larger the run, the more gentle the incline angle.



- For level changes greater than ½ inch (13 mm), install a ramp with maximum slope 1:12.
- A third, but less desirable option, is to make such transition hazards visually noticeable through appropriate detectable warnings. See section below titled Color, Contrast and Visible (Detectable) Warnings.
- Avoid one-step stairways if at all possible as they are not easily detectable.

Sidewalks, Curbs, and Parking Lots

A business owner may not be responsible for injuries resulting from a fall on a public sidewalk located outside his or her property. However, some courts may impose liability for injuries on a sidewalk used exclusively by customers coming to and from the business. Consult with your legal counsel if you have questions on liability.

A parking lot owner, however, can be responsible for maintaining the parking lot in a manner such that it is reasonably safe for people using it.

This includes:

- Filling and patching cracks and holes.
- Repairing and eliminating raised areas due to tree roots, settling, cold weather (frost heaves), and ordinary wear and tear.
- Reducing surface water by directing roof drainage away from sidewalks and parking areas.
- Clearing sidewalks/parking areas of snow/ice before employees and guests arrive.
- Centering and securing parking stoppers.
- Painting or staining parking stoppers near entrances Safety Yellow to improve visibility.



Curb Ramps and Handicap Ramps

State, local and national codes specify guidelines/requirements for curb ramps and handicap ramp design. For example, ramp slopes 1:15 minimum to 1:12 maximum with “slip-resistant” surfaces is often cited. There are no specific guidelines as to what “slip-resistant” means, but some codes specify grooving or other alterations of the curb ramp to improve slip-resistance. Check with your state and local codes for requirements on ramp slip-resistance guidelines. Handicap ramps and curbs are colored Safety Yellow (see section on Color, Contrast and Visible Warnings).

Entrances

Entrances represent unique slip and fall issues and are addressed in reference note LC 5408, *Preventing Slips and Falls: Selecting The Right Matting System*. For outdoor walkways at entrances exposed to the elements, consider installing a canopy to reduce snow, ice and water from being tracked into the building.

Color, Contrast and Visible (Detectable) Warnings

Recent U.S. Access Board Research recommends Safety Yellow as the preferred color for persons having very low vision. Safety Yellow, therefore, is a color standardized for use as a warning in the pedestrian/highway environment. Same is true for improving visual detection of elevation hazards on walkway surfaces. U.S. Access Board also specifies that visible warnings “shall contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light,” (70% contrast in light reflectance value LRV) therefore, allowing brightness contrast as further options for improving visual detection of transition hazards.

Ice, Snow, Water

Slips and falls from snow, rain and ice are common in northern climates. Falls can be caused by inadvertent accumulation of ice and snow due to misapplication. Misapplication can be caused by selecting less efficient deicing chemical(s) and friction additives (sand), and inadequately managing application schedules. Effective ice removal often occurs during the day with full sun. But, full sun will melt adjacent snow or ice, placing water on the de-iced walking surface. This will dilute the solution and tend to refreeze at night. With dropping temperatures, ice can re-form with falls occurring first thing in the morning.

Selection of ice melting chemicals

- Rock Salt (Sodium Chloride) is the least expensive but is somewhat corrosive and can damage concrete, interior surfaces and vegetation. It may need a wetting agent for application at low temperatures.
- Calcium Chloride and Magnesium Chloride are more effective than rock salt, and most effective at lower temperatures. Magnesium Chloride is somewhat less corrosive than Calcium Chloride, which is about as corrosive as rock salt.
- Calcium Magnesium Acetate is the most environmentally friendly, but is more expensive and is least effective at lower temperatures.

De-icing Chemicals	Use	Advantages	Disadvantages
Sodium Chloride (rock salt) NaCl	Plain or wetted with CaCl ₂	Cost	Corrosive, damages vegetation, environment issues
Calcium Magnesium Acetate (CMA)	Liquid mixed with salt or sand	Less corrosive than salt	Wet pavement, need twice as much as salt
Magnesium Chloride, MgCl ₂	Sprayed on, mixed with sand and other de-icers	Attracts moisture, dissolves and melts snow as it hits pavement	Road stays wet
Calcium Chloride, CaCl ₂	Mix with salt, pre-wets salt	Releases heat, helps snow melt, saves on salt	Cost

From Iowa Transportation Center, Iowa State University

The following are guidelines for managing slips and falls from snow, ice and water:

- Plow, shovel and use deicing, salting or ice melting chemicals to remove ice and snow.
- Pre-apply deicing chemicals before a storm, followed by snow/ice removal during and after the storm. Use plenty of deicing materials, as using “barely enough” will leave patches of ice.
- Check the surface regularly. For parking areas, this can be time consuming, but it is well worth the effort.
- Aim for evaporation. If the water can drain (e.g. drains aren’t blocked) and there is full sun, or even reasonable wind, the water and ice will evaporate. Dry pavement is a clear indication there is no ice.
- Use a friction additive. Sand is the most popular because it’s cheap. Use a lot of it. Make certain that anyone walking on the surface has a lot of traction. You can clean up the mess once the bad weather is over.
- Check and treat surfaces every morning, especially around snow piles where melting may have created new problem areas. Reevaluate during the day and re-treat as needed.
- Remember that a clean-looking surface is only “safe” if it’s dry. A wet surface can contain ice and can also turn to ice in the shade or overnight.
- Hold facility managers, custodians, grounds maintenance staff and contracted snow removal personnel responsible for snow and ice removal.
- Train those responsible in procedures for safely maintaining walkway surfaces, including the location of equipment and supplies.

Outdoor Lighting

Inadequate lighting may also lead to accidents involving falls in parking lots, trips over curbing, falls on a step or stairs from a parking lot to a store, and trips and falls due to holes, cracks and uneven surfaces.

Recommended outdoor lighting levels for general parking, ramps and corners, pedestrian areas and entrances are given in reference note LC 628, *Lighting for Safety and Performance*.

References

Bell, J.L., Collins, J.W., Wolf, L, Gronqvist, R., Chiou, S., Chang, W.R., Sorock, G.S., Courtney, T.K., Lombardi, D.A., and Evanoff, B., Evaluation of a Comprehensive Slip, Trip, and Fall Prevention Program for Hospital Employees, *Ergonomics*, 51:1906-25, 2008.

Slip, Trip and Fall Prevention for Healthcare Workers, DHHS (NIOSH) Publication Number 2011-123, December 2010.

U.S. Access Board: Americans with Disabilities Act (ADA) *Accessibility Guidelines for Buildings and Facilities*. July, 2004.

U.S. Access Board: *Technical Bulletin: Ground and Floor Surfaces*.

ASTM F1637, *Standard Practice for Safe Walking Surfaces*, ASTM International, West Conshohoken, PA.

ANSI/ASSE A1264.2 -2006, Provision of Slip Resistance of Walking/Working Surfaces.

Maynard, W.S., Chang, W.R and Curry, D.G., Industrial Flooring, *Health and Safety International*. 2004.

Technology News, August 1995, Iowa Transportation Center, Iowa State University.

American National Standards Institute (ANSI) Z535.1 – 2002, *Safety Color Code*.

International Organization for Standardization (ISO) 3864-2004, *Safety Colours and Safety Signs*.

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